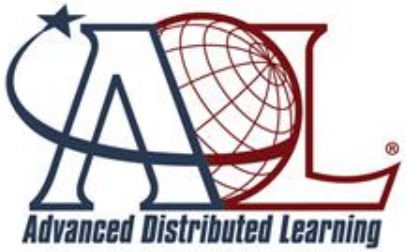

The Power of Global Collaboration

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Game Design and Cognitive Adaptability Study

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Dr. Gallagher provides contracted support to the Advanced distributed Learning (ADL) Initiative. The views expressed are those of the author and do not necessarily represent the views or policies of the ADL.

Study Goal

To better understand how game design affects cognitive adaptability…

- Define adaptability and cognitive adaptability (CA)
- Understand how to foster cognitive adaptability
- Translating findings on increasing CA into game design
- Test

ADL Next Gen Learner Games & CA Research Team

Matt Thomas

Jennie Bottone

Shenan Prestwich

Shane Gallagher

Peter Smith

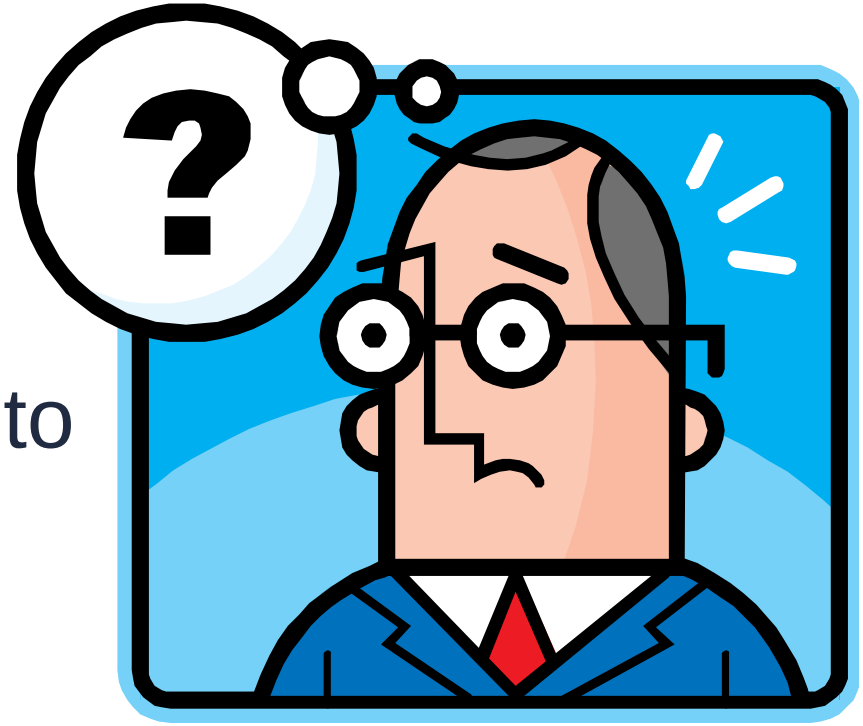
Peter Berking

Lou Wolford

So What…

What is cognitive adaptability and why do we care?

How is this related to video games?



What Is Adaptability?

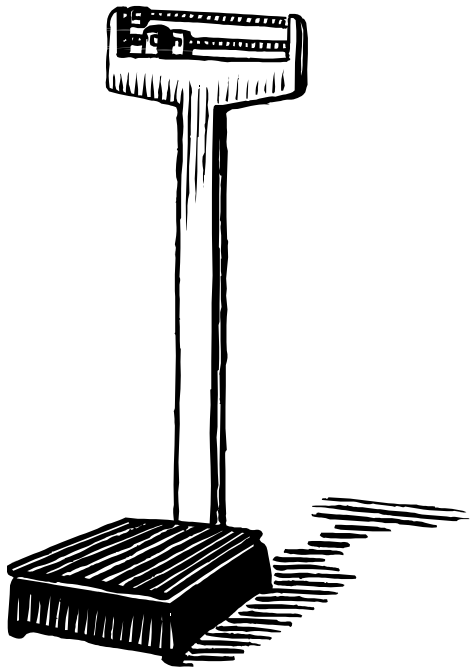
Adaptability: important metacompetency identified by U.S. DoD, DoL, DoE

Ability to use existing knowledge to create innovative problem solutions

Repeatedly trying new/different strategies to solve problems while reflecting on actions and incorporating feedback

"Questioning the norm…."

How can we frame it?

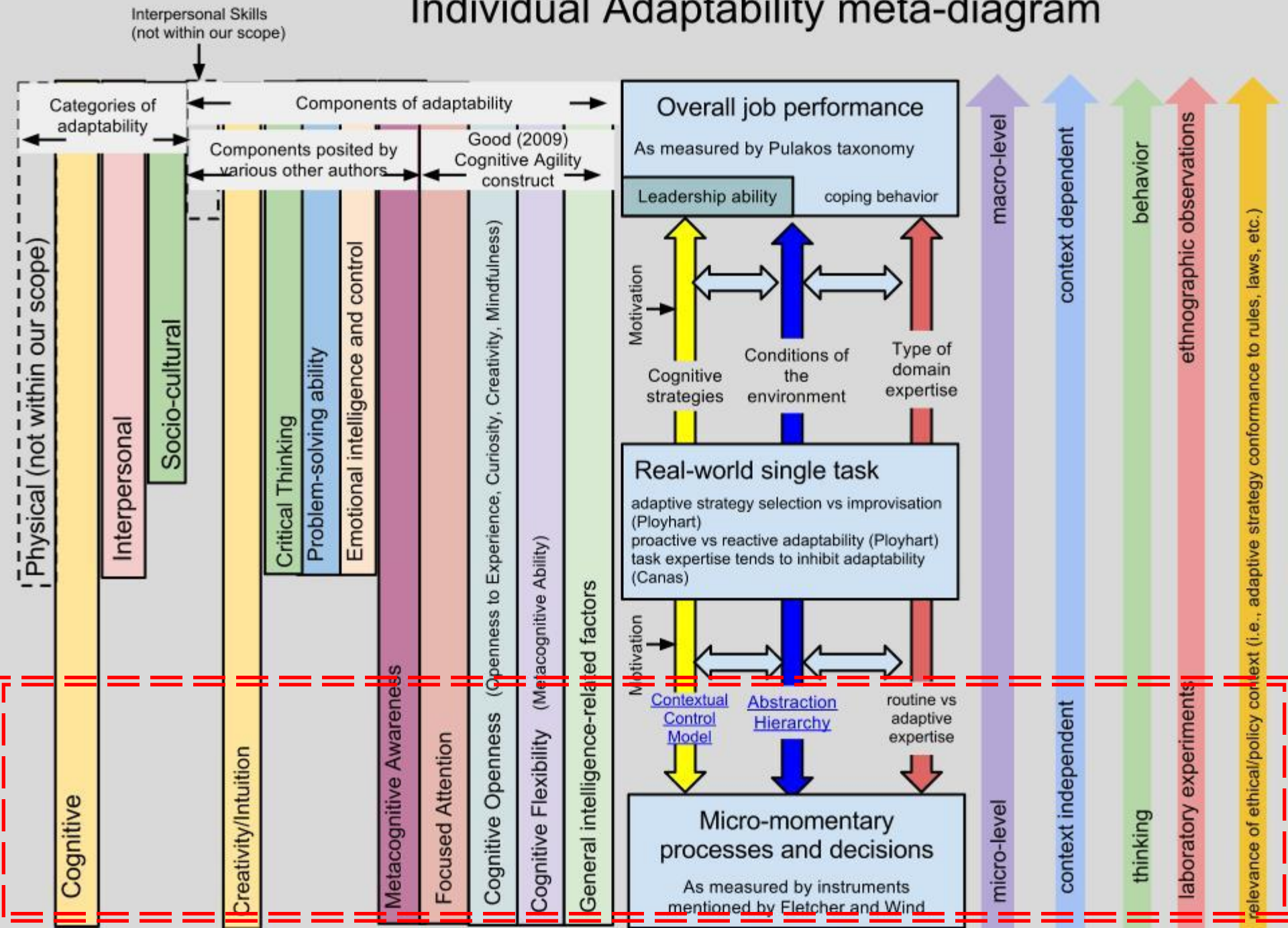


Scale of macro to micro

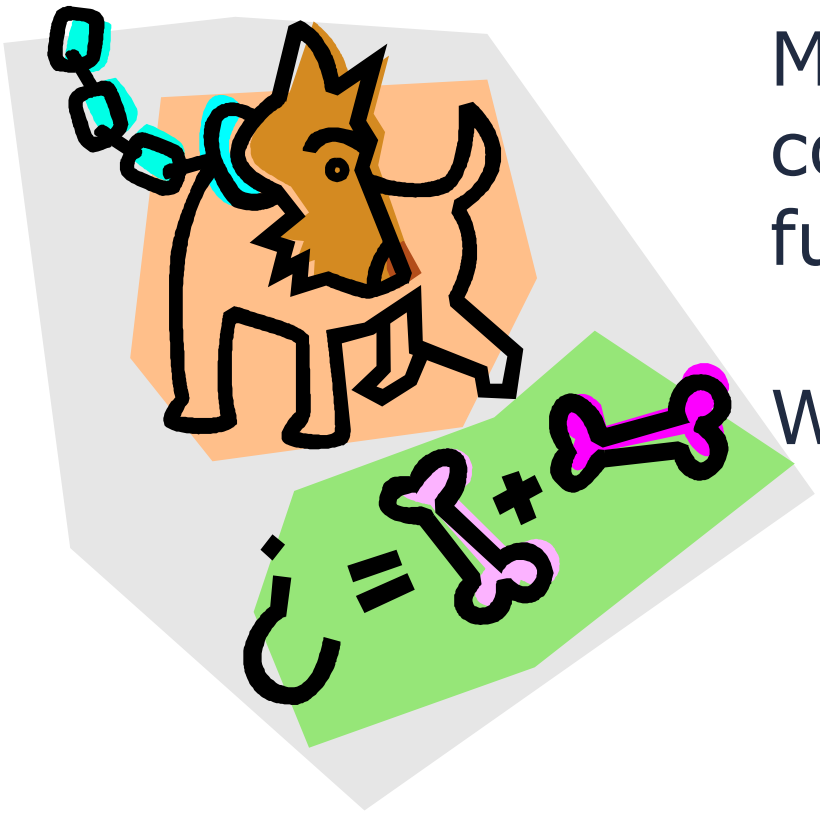
- Macro: adaptive stance, operational adaptability
-
- Mid: individual adaptive behavior

- Micro: micromomentary cognitive processes, i.e., cognitive adaptability

Individual Adaptability meta-diagram



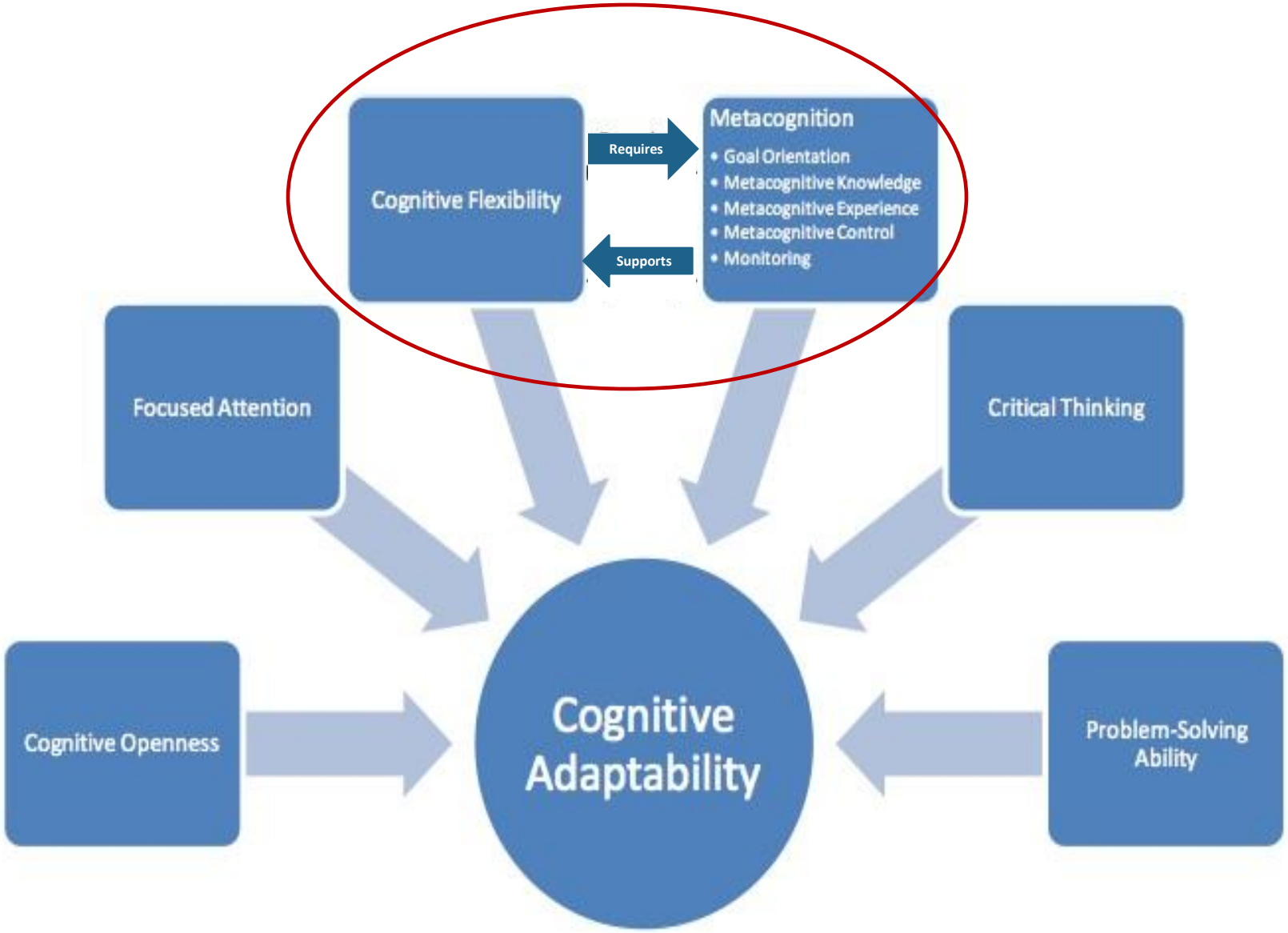
What is cognitive adaptability?



Micromomentary adaptive cognitive processes & functions

With components:

- Cognitive Openness/Creativity
- Focused Attention
- Cognitive Flexbility
- Metacognition
- Critical Thinking & Problem-Solving

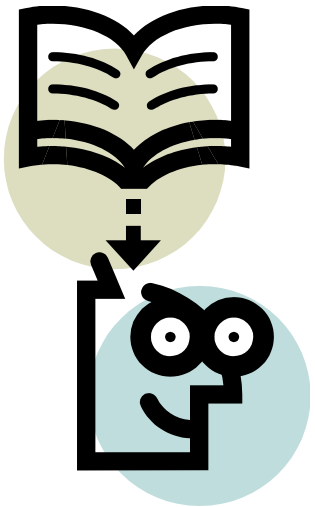

Cognitive Flexibility
Requires
Supports
Metacognition
• Goal Orientation
• Metacognitive Knowledge
• Metacognitive Experience
• Metacognitive Control
• Monitoring
Focused Attention
Critical Thinking
Cognitive Openness
Cognitive Adaptability
Problem-Solving Ability

Fostering cognitive adaptability

Metacompetency?
Learning environment design?
Conceptual framework?

Intersection with CA = research void
Had to draw from other areas of research and posit how these findings can be translated into design

- Cognitive remediation therapy (CRT)
- Feature overlap theory
- Game design - MDA



Intersecting domains

Cognitive Remediation Therapy (CRT)

- Neurocognitive psychotherapy technique aimed at improving cognitive flexibility, working memory, and planning in sub-normal populations

- Emphasizes practicing cognitive microskills Wisconsin Card Sorting Test, Stroop Color Word Test, interventions (verbalizing, scaffolding, errorless learning)

Intersecting domains

Feature Overlap Theory (Halpern, Hansen, & Riefer, 1990)

If training is too similar on a surface level to the actual event, students will reach for superficial connections

If training teaches a deep, causal understanding of the material but differs or varies on a surface level, students exercise ability to make deep connections and adapt knowledge.

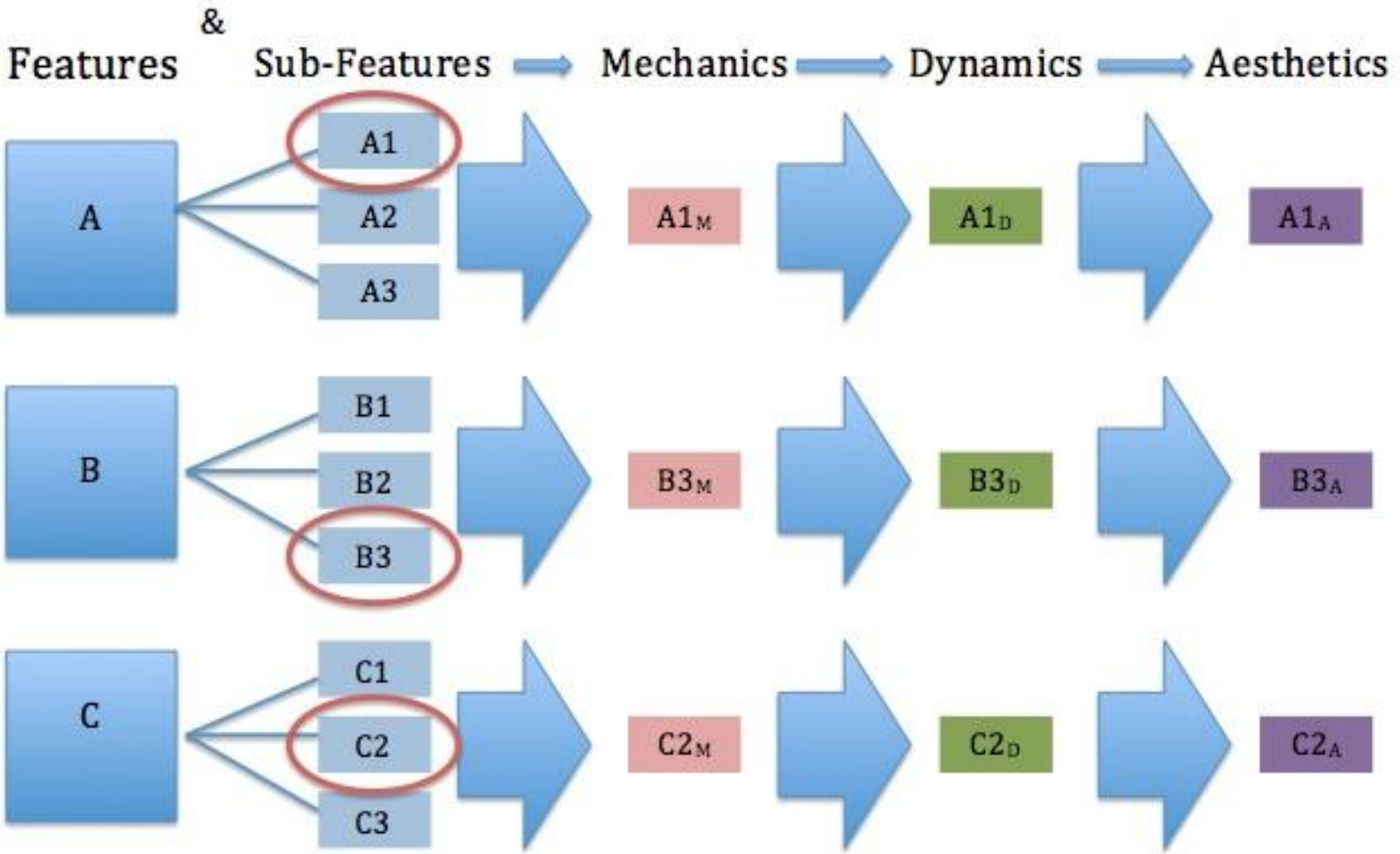
MDA

“…Hunicke, LeBlanc, and Zubek (2002), where mechanics are the components of a game at the level of data representation and algorithms, dynamics are how the game components interact with the player and vice-versa, and aesthetics comprise the emotional response evoked by the mechanics and dynamics…”

CRT FOT MDA Others…

Conceptual Framework for Developing CA

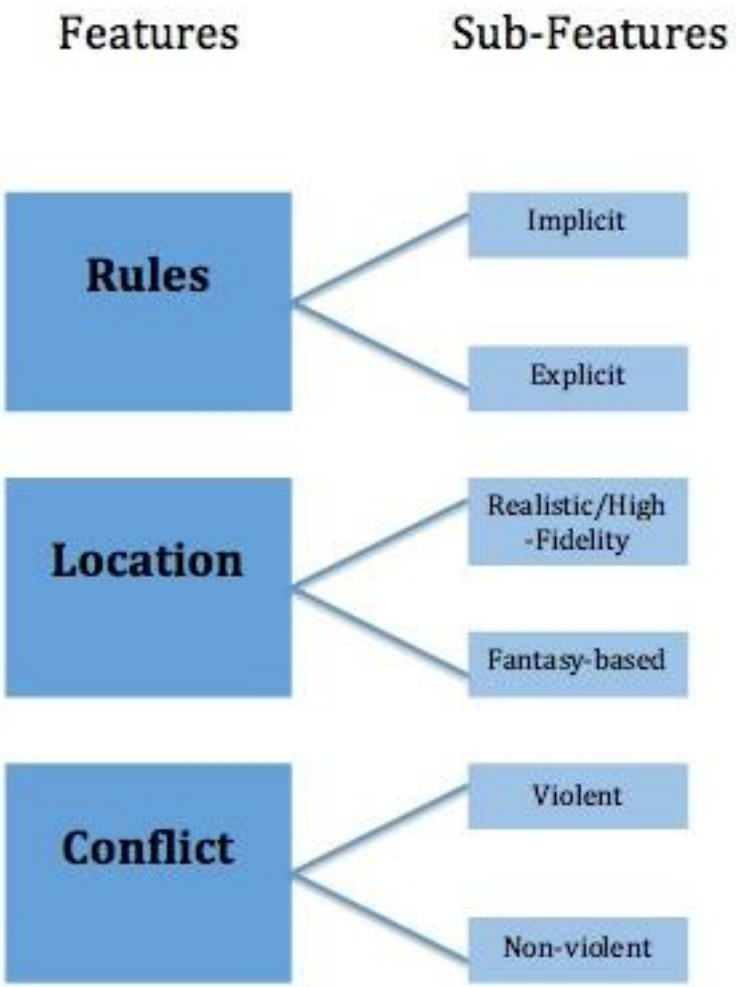
A variation on MDA: FFMDA



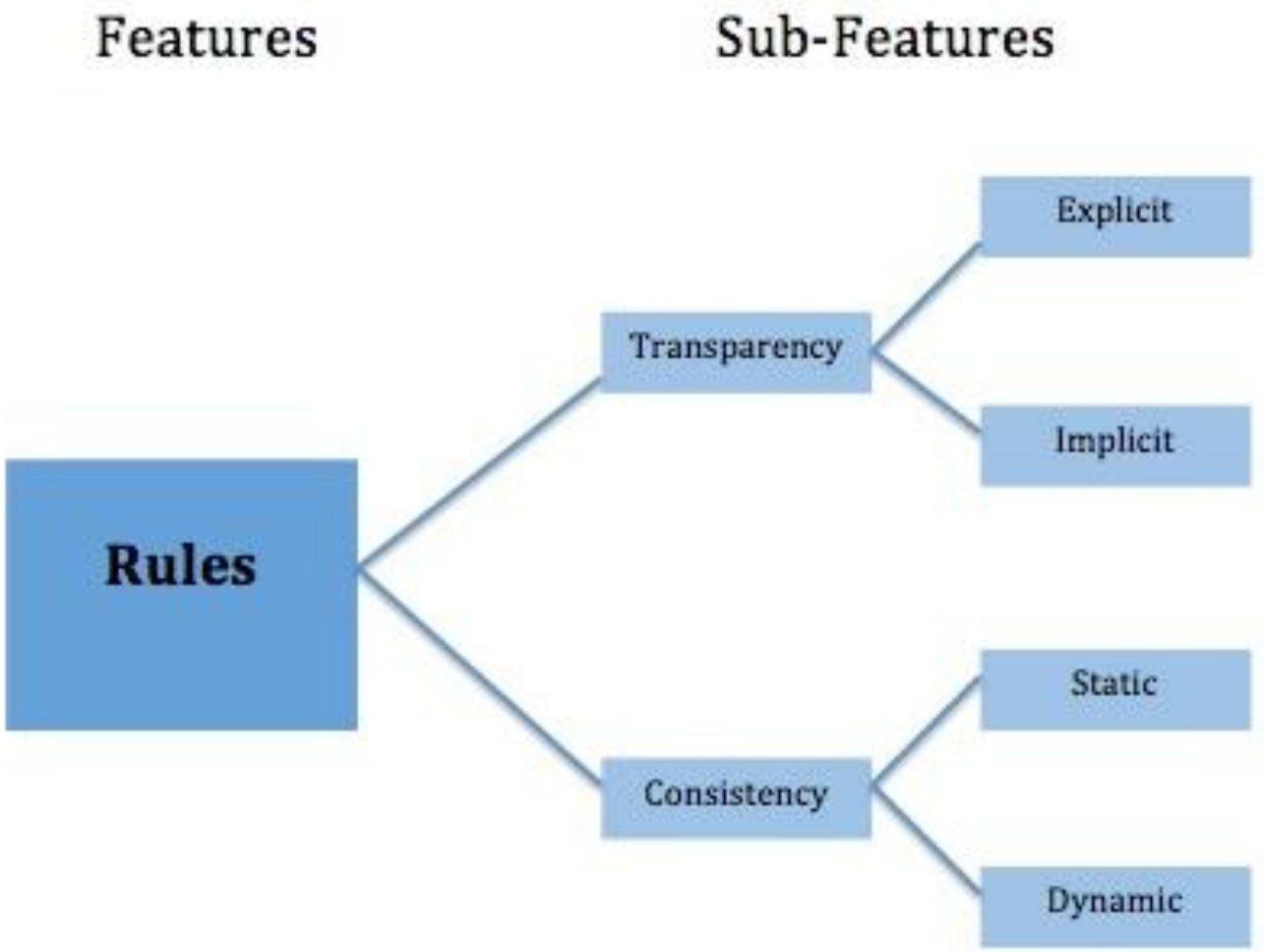
5 Features To Increase Cognitive Adaptability

1. Unstated/Implicit Rules
2. Unstated/Implicit Shifting of Rules
3. Dynamic Shifting Environments
4. Open-Ended Gameplay
5. Implicit Reinforcement for Individual Actions/Choices to Achieve Final Goal

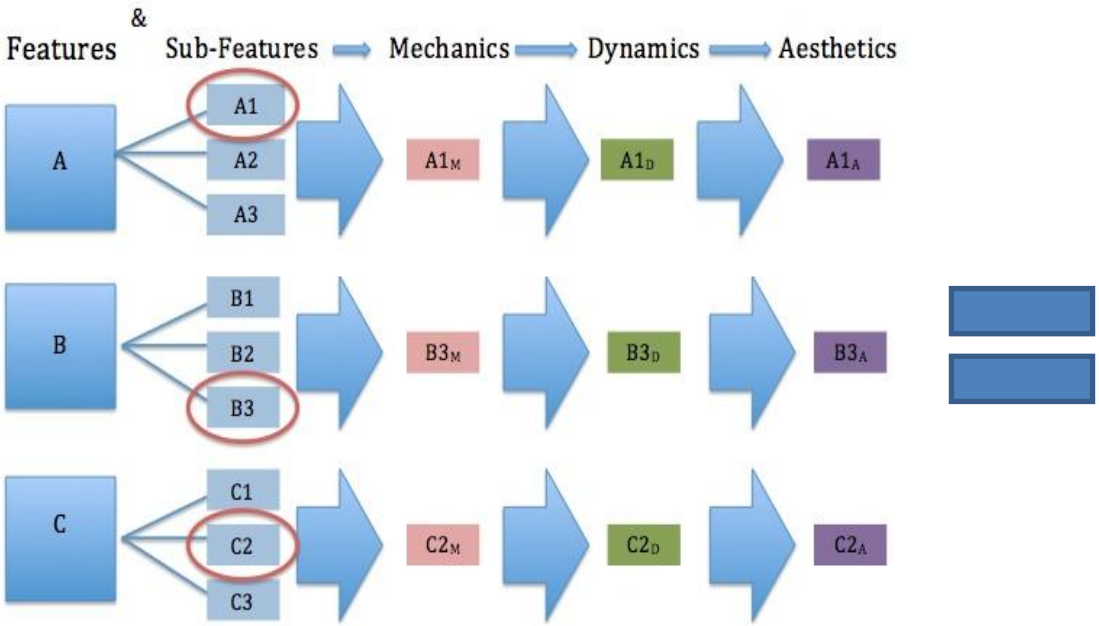
F_FMDA


Features
Sub-Features
Rules
Implicit
Explicit
Location
Realistic/High -Fidelity
Fantasy-based
Conflict
Violent
Non-violent

F_FMDA


Features
Sub-Features
Rules
Transparency
Explicit
Implicit
Consistency
Static
Dynamic

The Game


Features
&
Sub-Features
Mechanics
Dynamics
Aesthetics
A
A1
A2
A3
A1M
A1D
A1A
B
B1
B2
B3
B3M
B3D
B3A
C
C1
C2
C3
C2M
C2D
C2A

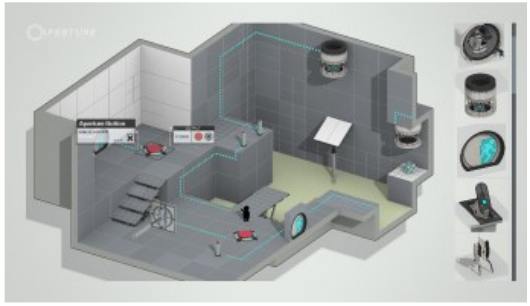

PORTAL 2
VALVE

Portal 2 Recognized for its Educational Potential

MARSHALL LEMON | 20 JUNE 2012 12:15 PM

4

Educational designers hope to learn from Valve's popular puzzle-platformer.



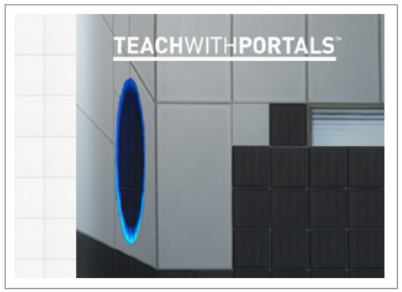
This week is the 9th Annual Games For Change Festival, a conference addressing the unique potential and needs of educational games. During a talk yesterday about science learning games, GameGuru's Scott Kirk and EdGE's Jodi Asbell-Clarke addressed one of the biggest challenges educational games face: by and large, they simply aren't very fun. To fix this problem, many edutainment developers are looking to commercial games for lessons on player engagement. Valve in particular is mentioned for *Portal*'s developer commentary, which contains incredibly detailed information on how to simultaneously engage players while orienting them to the game world.

"They're telling you why they built the pedagogy they did, what happened in the play-testing that gives you thei level of learning," Asbell-Clarke explained to the audience. "I've been an educator for 20 years, and I learned so much from that game."

Valve isn't a stranger to the educational games industry. Valve President Gabe Newell was actually a keynote speaker in 2011, and the company has since released a free version of *Portal 2's Perpetual Testing Initiative* for use in the classroom. While it's easy to think of *Portal* as a fun game, to teachers it's also an entertaining way to get kids thinking about spatial reasoning, problem solving, and physical principles. There's even a chance these kids will go on to develop sentient A.I. that act more like Atlas and less like GLaDOS.

Valve Reveals Portal 2 Educational Program

June 20, 2012



Valve has revealed Steam for Schools, a cool initiative that brings the joys of learning with Portal 2 to America's classrooms, at the Games For Change Festival. Steam For Schools, launching in a limited beta, will provide a limited Steam Client and a tailored version of Portal 2, along with the level editor and a workshop for hosting and organizing user-created levels. It will be free to teachers, who will have administrator access so that they can control what levels get shared.

While this particular version of the software is intentionally limiting because, as Valve's Leslie Redd says, "kids need a walled garden," Valve plans to make the program more open at some point.

Valve is using its own money to fund this educational initiative.

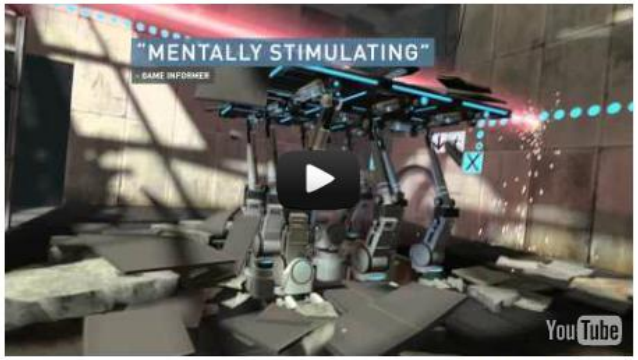
Those interested in learning more about getting into the beta this summer can sign up at www.teachwithportals.com.

Source: Joystiq

Portal 2: The Smartest Video Game Ever?

Previous Article Next Article

May 13, 2011 · 4:30 am PDT 2 comments Recommend 123



00:00/00:00

In this writer's extensive experience, modern video games—which trump even movies in the battle for the attention of today's youth—are almost universally mediocre. Formulaic plots (space marines/terrorists/aliens/orcs) and kill-or-be-killed gameplay is the standard, and a glassy-eyed, button-mashing, semi-satisfied player is the result. These games don't stimulate the mind or imagination, they only numb it.

The Study

Examine whether playing a commercial off-the-shelf game with the five identified features will increase cognitive adaptability

Research Questions:

(Q1) Will 12 hours of consecutive gameplay of a video game with the design features previously described (Portal 2) cause an increase in cognitive adaptability as measured by cognitive function tests (CANTAB)? Ind var =Portal 2 playtime
(Q2) Will those playing Portal 2 be more likely to be metacognitively aware during play than those not playing Portal 2? Ind var Portal 2 play history
(Q3) Will those possessing higher metacognitive awareness levels (MAL) also score higher on CANTAB after playing Portal 2 than those who didn't? Ind var Portal 2 playtime
(Q4) Are there differences of CA between high MAL (HMAL) and low MAL (LMAL)? Ind var MAL
(Q5) Is a prior history of playing Portal 2 or like games positively correlated with higher metacognitive awareness levels? Ind vars Portal 2 play history and MAL
(Q6) Will MA change over time during game play? Ind var Portal 2 playtime

How we did it…

June 8-17 2012

Provided:

- 39 Airmen
- touchscreen laptops
- facilities
- tech support on site

Used F_FMDA

- Portal 2

Measures

- CANTAB
- Metacognitive Awareness Inventory

Protocol

- Experimental
- 2 groups

Sample Population

N=39

- 18 – Control Group (MS Games)
- 21 – Experimental Group (Portal 2)

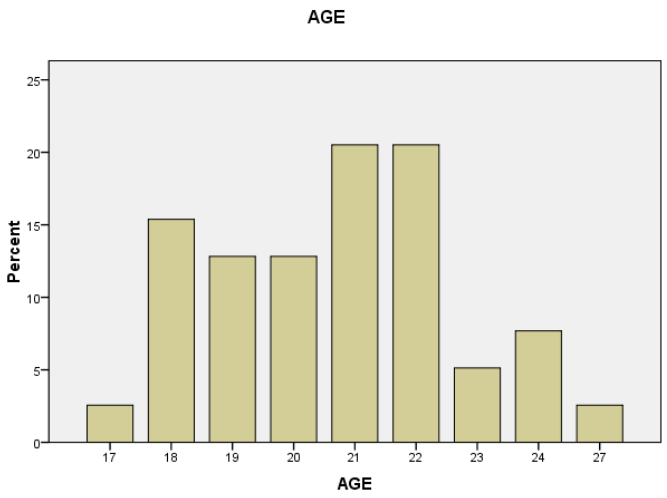
Age 17-24, Ave age = 21

Ave years in AF – 1.22

Rank – mostly E1-E3

Education – mostly HS Diploma

Gender – 5.1% Female, 94.9% Male



Measures

Cambridge Cognition CANTAB Eclipse
- Cognitive testing software
- Customized battery
- Tests executive functions and attention
- Baseline/Pre/Post

Metacognitve Awareness Inventory
- 36 item questionnaire
- Assess current state of metacognitive awareness
- Michael Haynie Syracuse Univerity Whitman School of Management

Game History Questionnaire

Active MA Survey
- 8 data points

Other qualitative data gathered – FRAPS recorded game sessions (3)

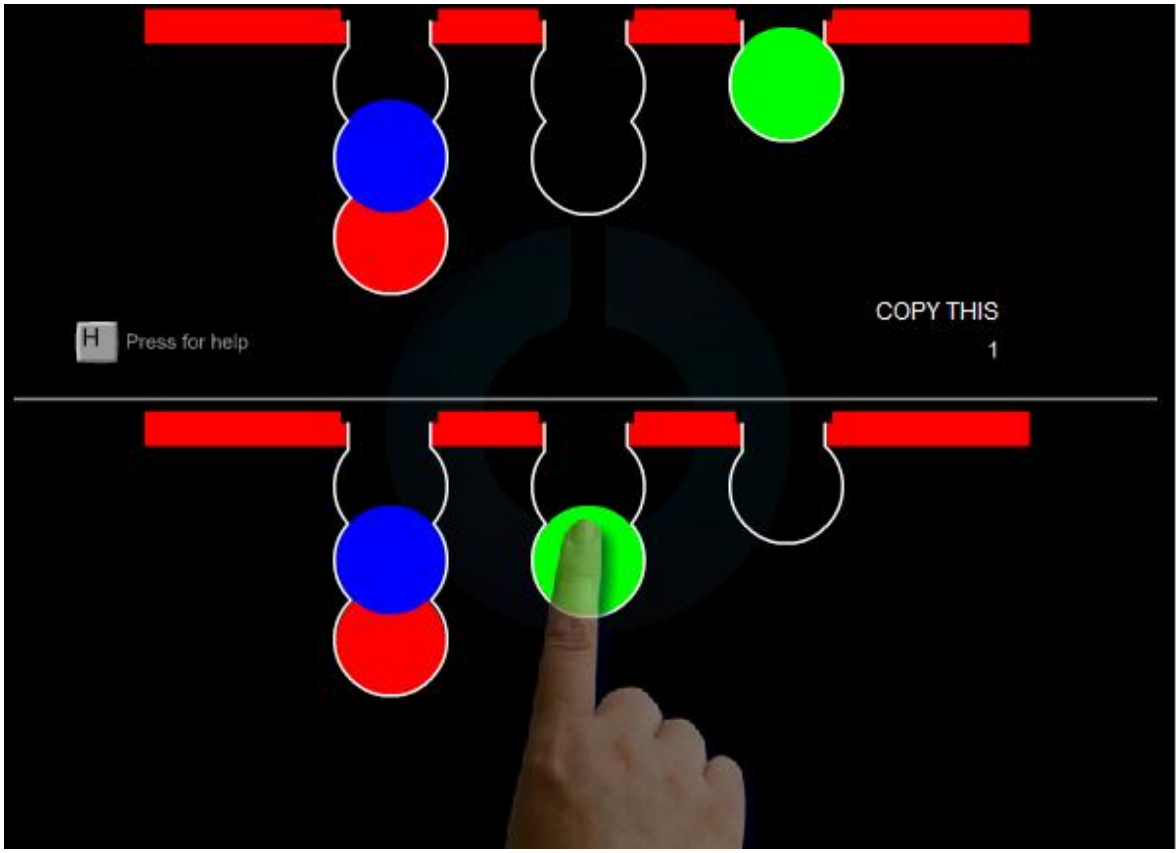
Procedure

June 8

CANTAB baseline administration

Used for mitigating practice effect in repeated measures

Rugged touchscreen laptops in computer lab



Procedure

June 14

CANTAB pre-test

Metacognitive Awareness Inventory

AMA

Metacognitive Awareness Inventory

Item	Statement	NOT very much like me ←								VER
1	I think of several ways to solve a problem and choose the best one.									
2	I challenge my own assumptions about a task before I begin.									
3	I think about how others may react to my actions.									
4	I find myself automatically employing strategies that have worked in the past.									
5	I think about what I really need to accomplish before I begin a task.									
6	I ask myself if I have considered all the options when solving a problem.									
7	I perform best when I already have knowledge of the task.									
8	I often define goals for myself.									
9	I use different strategies depending on the situation.									
10	I create my own examples to make information more meaningful.									
11	I try to use strategies that have worked in the past.									
12	I ask myself questions about the task before I begin.									
13	I try to translate new information into my own words.									
14	I organize my time to best accomplish my goals.									
15	I am good at organizing information.									
16	I try to break problems down into smaller components.									
17	I know what kind of information is most important to consider when faced with a problem.									
18	I consciously focus my attention on improtant information.									
19	My "gut" tells me when a given strategy I use will be most effective.									
20	I ask myself if there was an easier way to do things after I finish a task.									
21	I d epend on my intuition to help me formulate strategies.									
22	I periodically review to help me understand important relationships.									
23	I stop and go back over information that is not clear.									
24	I am aware of what strategies I use when engaged in a given task.									
25	I find myself analyzing the usefulness of a given stsrategy while engaged in a given task.									
26	I understand how accomplishment of a task relates to my goals.									
27	I find myself pausing regularly to check my comprehension of the problem or situation.									
28	I ask myself questions about how well I am doing while I am performing a novel task.									
29	I stop and re-read when I get confused.									
30	I focus on the meaning and significance of new information.									
31	I set specific goals before I begin a task.									
32	I ask myself if I have considered all the options after I solve a problem.									
33	I ask myself how well I've accomplished my goals once I've finished.									
34	I re-evaluate my assumptions when I get confused.									
35	When performing a task, I frequently assess my progress against my objectives.									
36	I ask myself if I have learned as much as I could have when I finished the task.									

DAY 1						
	10:00	1- Strongly Disagree	2 - Disagree	3 - Neutral	4 - Agree	5 - Strongly Agre
1	I consciously thought of several ways to solve a problem and chose the best one.					
2	I did not challenge my own assumptions about a task before I began it.					
3	I found myself automatically employing strategies that have worked in the past.					
4	I changed strategies depending on the situation.					
5	I did not re-evaluate my assumptions when I became confused.					
6	I became better at playing the game.					

Procedure

June 15-16 Airmen played either

Portal II (Intervention)

- Has the 5 features that should promote CA
- Play for 6 hours over 2 days (12 hours total) with breaks every 1.5 hours
- AMA questionnaire each break
- N=21

OR

Solitaire, Minesweeper, FreeCell, and Mahjong (Control)

- Do not have the 5 features that should promote CA
- Commonly found in MS Windows 7
- Puzzle/Logic games
- Play each for 1.5 hours a day over 2 days (12 hours total)
- AMA questionnaire each break
- N=18

Procedure

June 17 (final day)

- CANTAB posttest
- Game History Questionnaire

Some initial discoveries…

- Average plays 6-9 hrs/wk
  - True for Exp and Control
- Most have never played Portal or Portal 2 before or have spent little time if they did
  - True for Exp and Control
- Majority indicated that time spent playing video games has decreased in the past year and in the past 5 years

Metacognitive Awareness Inventory

- Average Score = 78%, Range 65%-95%
- Results are still being analyzed and will be presented when final.

Questions?

For more information contact:

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703-575-3718